

130E-1

## TOOL SAFETY, USE AND IDENTIFICATION

AG130E

### UNIT OBJECTIVE

After completion of this unit, students will be able to identify the importance of tool identification and safe tool use in the agricultural mechanics industry in the United States, Idaho, and the local community. This knowledge will be demonstrated by completion of assignment sheets and a unit test with a minimum of 85 percent accuracy.

### SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Identify all the tools listed in the AG 130 CURRICULUM GUIDELINES unit on tool & hardware identification.
2. Demonstrate the proper and safe use of the tools to be used in the agricultural mechanics program.
3. Use tools properly and safely.

## TOOL IDENTIFICATION, SAFETY AND USE

### A. Introduction

1. Accidents occurring in the agricultural mechanics shop often occur because students do not have a basic understanding of shop procedures, rules of conduct, and general shop safety. The purpose of this lesson is not only to identify many of the power tools used in the shop, but also to provide students with proper operating procedures and safety techniques involved with each lab.

### B. Woodworking Power Tools

1. Circular Saw - The circular saw is the most useful of all woodworking machines. It can be used for crosscutting, ripping, mitering, beveling, chamfering, rabbeting, cove cutting, tapering, shaping, and molding cutting. This tool is used in situations where the work cannot be moved to the shop or in a shop where table saws are not available. Circular saws come in a variety of blade sizes ranging from 6 1/4" to 8 1/2."

#### a. Operating Procedures for the Circular Saw

- 1) Secure the material to be sawed in a vise or with clamps to the work table.
  - 2) Mark the line of cut with a pencil.
  - 3) Install the proper blade suited to the material being cut.
  - 4) Grasp the saw firmly with both hands. Start the saw and allow the blade to reach full operating speed before making contact with the material being sawed.
  - 5) Allow the saw to move at its own rate through the wood. Do not force the saw.
  - 6) Protect the electrical cord from the line of the cut.
  - 7) Always use both hands to hold and guide the saw.
  - 8) Clear away scraps of wood on the table only after the saw stops running.
2. Band Saw - The band saw is a useful wood cutting tool which has an endless blade traveling around two wheels. Size is determined by blade diameter.

#### a. Types of Band Saws

- 1) The mill band saw is used for sawing logs into lumber.

- 2) The re-saw type is used to saw thick stock into thin stock.
- 3) The small band saw is used to saw straight and curved cuts in wood.

b. Adjusting the Band Saw

- 1) Remove the wheel guards and table insert. Loosen the guide pins and blade-support rollers.
- 2) Loop the desired blade through the slot in the table and around the tapered bottom wheels. Make sure the teeth are pointing down through the table.
- 3) Adjust the tilting screw of the top wheel until the top wheel is in line with the bottom wheel.
- 4) Tighten the tension screw.
- 5) Adjust the top guide until the front edges of the guide rollers are just behind the saw teeth. The teeth must never run between the guide rollers.
- 6) Rotate the wheels to see if the saw is properly adjusted. Replace all safety guards.
- 7) Turn the saw on and off to see if it has been properly adjusted.

c. Operating Procedures for the Band Saw

- 1) Always mark the material to be cut.
- 2) Use a thin blade for sawing curves and a thick blade for re-sawing, cross cutting, and ripping.
- 3) Allow the blade to set the pace of the cut. Do not force the material into the blade.

d. Safety Precautions when using a Band Saw

- 1) Wear safety glasses.
- 2) Use a push stick when sawing small wood stock.
- 3) Never use cracked or kinked saw blades.
- 4) Never twist the blade when sawing curves.
- 5) Try to avoid backing out of a cut, because this can bind and break the blade.
- 6) Keep fingers clear of the moving blade.
- 7) Stop the saw before removing scraps.

3. Portable Electric Saw - The portable electric saw is a combination of circular saw and a power hand saw. It can be used for ripping, or crosscut sawing. The portability of this saw makes it a valued tool in construction and repair work. The portable electric saw can be used with attachments to perform the same jobs as a table circular saw and a radial arm saw.

a. Operating Procedures for the Portable Electric Saw

- 1) The operating procedures for the portable electric saw are the same as those for the circular saw.

b. Safety Precautions when using a Portable Electric Saw

- 1) Do not use dull or worn blades.
- 2) Bring the saw to full speed before cutting and push the saw slowly and steadily into the work.
- 3) Do not reach over or around a saw that is running.
- 4) Do not use the saw in awkward positions.
- 5) Keep all parts of the body away from the blade while it is in operation.
- 6) Keep the cord away from the blade to prevent electric shock.

4. Cut-off or Radial Arm Saw - The radial arm saw is used to cut long pieces of wood down to a more usable size. The advantage of a radial arm saw is that the work remains stationary when cross cutting, and the saw comes down onto the work instead of up into it. This eliminates the awkward process of pushing long pieces of lumber across the saw table.

a. Operating Procedures for the Radial Arm Saw

- 1) Set the blade depth at a length that penetrates the width of the work but does not saw through the baseboard.
- 2) Brace the work against the fence, which acts as a support on the baseboard.
- 3) Start the saw and bring it to full working speed.
- 4) While bracing the work with one hand, pull the saw body across the work, keeping both hands clear of the blade.
- 5) Place the saw back in its starting position. Turn the saw off and wait for the blade to stop before removing work pieces and set-ups.

- 6) For ripping, the saw motor must be locked parallel to the fence.
- 7) The work is pushed through the saw with a procedure similar to that of a circular saw. Always push the work into the saw from the direction indicated on the saw guard. If fed from the rear, flying wood chips may injure the operator.

b. Safety Precautions when using a Radial Arm Saw

- 1) Always wear a face shield or safety goggles.
- 2) Hold the work firmly against the fence.
- 3) Stand to one side of the direction of the blade and keep hands and body parts away from the blade.
- 4) Feed the saw into the wood only as fast as it will easily cut.
- 5) Never cut more than one piece of stock at a time.
- 6) Return the saw to the beginning position, turn the power off, and wait until the blade has completely stopped before removing scraps of the work material.

5. Jigsaw (also called the scroll saw) - The jigsaw has a short blade that moves up and down, cutting only on the down stroke. The scroll saw is used for cutting curves and fine detail in thinner stock. It can also be used to cut light metal and plastic.

a. Operating Procedures for the Jigsaw

- 1) Mark the line of the cut with a pencil.
- 2) To cut center sections of the material, drill a hole in the work, disconnect the blade and pass it through the hole, and then reconnect it.
- 3) Start the saw and feed the material with gentle pressure along the pencil marks.
- 4) When starting at the edge of the material, simply feed the material with light pressure through the saw blade.

b. Safety Procedures when using a Jigsaw

- 1) Wear a safety shield or goggles.
- 2) Keep hands and body parts away from the moving blade.
- 3) Never feed the material faster than the saw can easily cut. The jigsaw blade is thin and can easily break.

- 4) Check the blade for proper adjustment and alignment before starting in order to prevent broken blades.

6. Saber Saw - The saber saw is simply a portable jigsaw. It is also referred to as a sabre or bayonet saw. The saber saw can be used to cut plastics, wood, fiberglass, plexiglass, and thin metals.

a. Operating Procedures for the Saber Saw

- 1) Secure the work to be sawed to a bench or table.
- 2) Mark the line of the cut with a pencil.
- 3) Place the edge of the blade against the material before starting. With all other saws, the blade is brought to speed before touching the material.
- 4) Start the motor and feed the blade through the work. Allow the blade to cut at its own rate.
- 5) When cutting interior sections of the material, drill a hole and place the saw blade through the hole before starting.

b. Safety Precautions when using a Saber Saw

- 1) Wear a face shield or safety goggles.
- 2) Remove all nails, staples, and loose knots from the material.
- 3) Do not force the blade through the material.
- 4) Keep hands clear of the blade.
- 5) Protect the electrical cord from the blade.

7. Planer or Surfacer - The planer is used to plane boards smooth to an even thickness.

a. Parts of the Planer or Surfacer

- 1) Planer knives are mounted on the revolving cutter-load. There are usually 24 to 27 knives in each planer. The rotating knife blades remove material from the wood that is passed over it.
- 2) Planer Bed - The planer bed is the flat support that guides the wood over the blades.
- 3) Pressure Bar - The pressure bar holds the lumber down on the bed rollers and keeps the end of the board from being dropped out as it leaves the cutter head.

- 4) Feed Rollers - The two spring rollers operate under spring compression and feed the lumber through the planer.
- 5) Chip breaker - The chip breaker breaks the chips off near the cutter head and deflects them over it; this prevents chip buildup near the blade which will result in uneven cutting or tearing of the wood.
- 6) Material Thickness Gauge - The material thickness gauge indicates the exact thickness to which the material will be surfaced or planed.

b. Operating Procedures when using the Planer

- 1) Set the material thickness gauge to the desired dimension.
- 2) When surfacing several pieces of lumber with varying thicknesses, sort the lumber into piles according to the thickness and plane down until even. This will require fewer adjustments to the surfacer and result in less variation of the final product.
- 3) Feed the lumber through several times while turning the board over each pass. This will insure even planing.
- 4) Continue passing the boards through until one side is smooth and the desired thickness is reached.

c. Safety Precautions when using a Planer

- 1) Wear a safety shield or goggles.
- 2) Wear hand protection.
- 3) Keep the face and body clear of the feed roll area to prevent injury from flying splinters.
- 4) Remove all knots, nails, and staples from the wood before planing.
- 5) Keep the planer knives sharpened and properly adjusted.
- 6) Keep hands at a safe distance from the moving parts in order to prevent them from getting sucked into the blades.
- 7) Wear hearing protection when operating or working near the planer.

8. Jointer - The jointer is similar to a planer in that it is used to smooth a surface of a board. It can also be used to square an edge, bevel, or chamfer.

a. Operating Procedures for the Jointer

- 1) Adjust the front and rear tables to the same height. If improperly adjusted, a smooth cut is impossible.
- 2) Adjust the fence, which acts as a feed guide and angle indicator.
- 3) Adjust the knives to the desired height to prevent chipping and tearing. The blades should not be raised more than 1/16" above the tables.
- 4) Place the edge of the lumber on the front table. Apply sideways and downward pressure to hold it flat and against the fence.
- 5) Run the board through the jointer.
- 6) To use the jointer to bevel wood:
  - a) Use a T-bevel to set the fence at the desired angle.
  - b) Set the front table to the desired depth of the cut.
  - c) Press the board down and against the fence while pressing over the jointer blades.
- 7) To use the jointer to rabbet boards:
  - a) Rabbeting is a process used to make lap joints in boards.
  - b) Adjust the depth of cut to half the thickness of the board.
  - c) Remove the front guard.
  - d) Set the fence 1/2" from the left end of the cutting blades.
  - e) Pass both boards over the jointer.
- 8) To use the jointer for tapering:
  - a) Divide the board into equal lengths of 6" or 8."
  - b) Set the blade height to plane the first section.
  - c) Plane the first section and readjust the jointer blades. Continue this procedure for the length of the board.
  - d) Even the taper using a hand plane.



b. Safety Precautions when using a Jointer

- 1) Wear a safety shield or goggles.
- 2) Use a push block to move the wood across the jointer.
- 3) To prevent injury from the blades never joint lumber less than 10" long.
- 4) Joint with the grain to prevent splinters.
- 5) Keep the knives sharp and properly adjusted.
- 6) Use the fence to support the stock.
- 7) Keep hands away from the cutter-head; never pass hands directly over the cutting head.

9. Shaper - The shaper is used to cut specialized shaped edges, moldings, and picture frame stock. Safety should be stressed while using the shaper because wood is fed directly into a rotating, exposed blade.

a. To shape straight edges:

- 1) Adjust the fence of the shaper to the desired depth of the cut.
- 2) Select and install the desired cutting bit.
- 3) Start the shaper and run the board along the fence, holding it securely with hands to the side of the board away from the blade.
- 4) Run the board along the fence smoothly and quickly to avoid burning the wood.

b. To shape curved pieces of wood, remove the fence and follow the same procedure. The wood can still be burned or scored if passed too slowly across the blade.

c. Test the setup on a sample piece of wood before shaping the project material.

d. Safety Precautions when using a Shaper

- 1) Wear a face shield or safety goggles.
- 2) Make sure the stock is free from loose knots, cracks, or other defects.
- 3) Use the fence whenever possible.
- 4) Use a push stick whenever possible.
- 5) Push all work opposite to the direction of the rotation of the cutter.
- 6) Keep hands well away from the revolving cutters.
- 7) Turn the power off and wait until the cutter has stopped before removing shavings.

10. Router-Shaper - The router is a portable shaper that moves over the work instead of the work being moved through the blade.

a. Operating Procedures for the Router

- 1) Secure the work in a vise or with clamps to a work bench.
- 2) Mark the area to be routed with a pencil.
- 3) Select the desired router bit and router guide and attach securely.
- 4) Grasp the router firmly with both hands.
- 5) Bring the bit to full running speed and slowly ease into contact with the wood.
- 6) The bit will pull itself along the cut. Move the router from the left to the right for the cleanest cut.

b. Safety Procedures when using a Router

- 1) Fasten the bit securely to the chuck. The bit should be at least 1/2" into the chuck.
- 2) Wear a face shield or safety goggles.
- 3) Be sure the switch is in the off position before plugging in the electrical cord.
- 4) Hold the machine firmly with both hands.
- 5) Keep hands clear of the cutting bit.
- 6) Turn the power off and wait until the blade has stopped rotating before resting it on its side.

11. Sanding Machines - There are many types of power sanders including disc, belt, drum, spindle, and sheet sanders. Power sanders use abrasive paper or cloth that spins at high speeds to remove material from the project stock. Sanders can come attached to a stand or as a variety of possible electric models.

a. Belt Sanders - The belt sander is the most powerful sander. It is used to strip paint and varnish, remove corrosion and rust, polish surfaces, or remove a large amount of material as quickly as possible.

1) Operating Procedures for the Belt Sander

- a) Secure the material to a vise or to a workbench.
- b) Place one hand on the front knob and the other on the rear handle.

- c) Use the rear hand to press the starter trigger. Bring the belt to full working speed before making contact with the work.
- d) Touch the heel of the sander to the work and then ease the entire belt surface onto the wood.
- e) Use back and forth, and sideways motions to evenly sand

b. Finishing Sanders - The finishing sander is used for minor sanding and touch-up jobs. The two types of finishing sanders are straight line movement and orbital. Straight line sanders move back and forth while orbital movement is circular; dual-motion sanders are also available.

#### 1) Procedures for Replacing Sandpaper Sheets or Spring

- a) Lift the front clamp and insert the sandpaper end in until it meets the posts and is even with the plate.
- b) Release the lever and press down firmly.
- c) Fold the paper over the base plate and under the clamp. Draw the paper as tightly as possible and lift the rear clamp. Insert the other end of the paper squarely, release the lever, and press down firmly.

#### 2) Procedures for Replacing Abrasive Paper on Knurled Roller Sander

- a) Insert the abrasive paper between the roller and the top of the base plate.
- b) Turn the roller with a screwdriver while holding the paper edge against the knurled roller.
- c) Fold the paper under the plate.
- d) Repeat the operation for the rear roller.
- e) Draw the paper as tightly as possible.

c. Disk Sanders - A disk sander is simply an abrasive paper attachment that is used on portable grinders. Disk sanders are best for paint removal, coarse shaping, and rough sanding. The high speed of the disk sander can cause gouges and chips; consequently, it is not recommended for finish work.

- d. Contour Sander - The contour sander is used on irregular and curved surfaces. The contour sanding attachment can be used on motor shafts, lathe chucks, drill presses, and electric drills.
- e. Safety Precautions when using Power Sanders

- 1) Wear a safety shield or goggles.
- 2) Check the condition of the abrasives.
- 3) Wear a respirator where no catch bag is available to reduce dust.
- 4) Never touch the moving abrasives.
- 5) Bring the sander to working speed before coming into contact with the work. Remove the sander from the work before stopping the sander.

- 12. Wood Turning Lathe - The wood lathe is used to shape wood into various round, cylindrical shapes. The wood is spun at a high rpm while the operator shapes it with various hand tools.

- a) Operating Procedures for the Wood Turning Lathe

- 1) With a punch or awl mark the dead center on both ends of the wood stock to be used.
- 2) Embed the centers into the dead center of the wood. Use oil or beeswax to lubricate the center before inserting.
- 3) Clamp the tailstock firmly in place.
- 4) Turn the rough stock one revolution by hand.
- 5) Start the lathe at the lowest speed.
- 6) Adjust the tool rest to 1/8" from the rough stock. Use a gauge to rough the wood to round form. Start 2" from the tail stock and work forward.
- 7) Increase the speed to 2,400 - 2,800 rpm's and use various handtools to reach desired shape. Always keep the tool rest 1/8" from the wood.
- 8) Remove the tool rest to sand at high speeds.

- b) Safety Precautions for the Wood Turning Lathe

- 1) Wear a safety shield or goggles.
- 2) Make sure the stock is free from loose knots, nails, or other defects.
- 3) Be sure stock is properly mounted and secured to the lathe.
- 4) Make sure the tool rest is properly adjusted and clamped securely.

- 5) Do not shift belt or belt-driven lathe to a different speed while running.
- 6) Hold turning tools firmly against the rest with both hands.
- 7) Never touch the stock while it is revolving.
- 8) Stand to one side when the power is first turned on.

13. Mortiser - The mortiser is used solely for making mortises. A drill attachment can also serve the same purpose. Mortises are required on doorjams and in specially built furniture. Chisel bits are inserted into the mortise chuck to cut different size mortises.

a) Operating Procedure for the Mortiser

- 1) Select a chisel and place it in the casting. Slightly tighten the setscrew.
- 2) Push a mortising bit up through the hollow chisel. Tighten the assembly.
- 3) Turn the feed lever down, and lock the quill in its lowest position.
- 4) Adjust the fence so that the chisel and fence are square with each other.
- 5) Cut the mortise by evenly pushing the chisel onto the wood.

b. Safety Precautions when using a Mortiser

- 1) Clamp all stock securely to the table.
- 2) Wear a face shield or goggles.
- 3) Keep hands away from the chisel when the machine is turned on.
- 4) Feed the chisel only as fast as the machine will easily cut.
- 5) Lift the bit clear of the mortise before moving table.

C. Metalworking Tools

1. Bar Folder/Brake - The bar folder and the brake are used to bend and fold a variety of metal stock and to bend sheet metal. The procedures for using the tools varies depending upon the size of the metal used, the type of bend desired, and the angle of the bend. Read the manufacturer's directions for operating procedures.

a. Safety Precautions when using a Bar Folder/Brake

- 1) Keep hands clear of movable parts.
- 2) Remove all sharp burrs and edges from the metal before folding.
- 3) Fold only single thickness of sheet metal within the capacity of bar folder or the brake.
- 4) Let the bar down slowly after completing the bend.

2. Metal Shear - The metal shear is used to cut large pieces of sheet metal. Bench shears come in different sizes, the most common shop size being a 30" shear with a 7" cut.

a. Operating Procedures for the Metal Shear

- 1) Lift the top handle and feed the metal through the front.
- 2) Push the top handle down with both hands through the sheet metal.
- 3) Use the guide to cut straight strips of metal.

b. Safety Precautions when using a Metal Shear

- 1) See that all guards are in place.
- 2) Stand directly in front of the machine.
- 3) Keep fingers away from the clamp and blade.
- 4) Cut only single pieces of metal.

3. Bench Grinder - The bench grinder is a motor driven wheel made of various abrasives. It is used to remove or polish the metal. Different grinding wheels are installed depending on the job to be performed or the amount of material to be removed.

a. Operating Procedures for the Bench Grinder

- 1) Adjust the tool rest to no more than 1/8" from the grinding wheel. The tool rest should be no closer than 1/16" from the wheel.
- 2) Start the grinder while standing to the side of the wheel.
- 3) Grasp the object to be ground firmly in both hands.
- 4) Slowly move the tool to the moving grinding wheel while supporting it on the tool rest.

b. Safety Precautions when using a Bench Grinder

- 1) The tool rest must be properly set at 1/16" to 1/8" from the wheel to prevent the wheel from pulling the tool down between the tool rest and the wheel.
- 2) Wear a safety shield or goggles even if the grinder is equipped with a face shield.
- 3) Keep hands away from the shield when it is in motion.
- 4) Do not wear loose clothing or gloves near the wheel.
- 5) Grind only on the face of the wheel; grinding on the side may cause the wheel to break.

4. Buffer - The buffer is used to polish metal. A buffing wheel is attached to a bench or portable grinder.

a. Operating Procedures for the Buffer

- 1) See operation procedures for the bench grinder.
- 2) A buffing compound is generally applied to polish the material being buffed.

b. Safety Precautions when using a Buffer

- 1) Wear a safety shield or goggles.
- 2) Apply compound sparingly.
- 3) Keep hands away from the wheel when it is in motion.
- 4) Buff flat surfaces from the center toward the lower edge. All sharp edges should point downward when being buffed.

5. Portable Grinder and Disk Sander - The portable grinder and disk sander are useful tools for removing excess material from objects that are too large or too heavy to place on a bench grinder.

a. Operation Procedures for the Portable Grinder and Disk Sander

- 1) Secure the object to be ground in a vise or to a table with a clamp.
- 2) Hold the grinder firmly with one hand on the handle and the other on the body and trigger.
- 3) Hold the grinder away from the body and start it, bringing it to full speed.
- 4) Ease the grinder wheel to the project. The wheel face should be flat on the project.

- 5) Angle the grinder so that the sparks fly away from the operator.
- 6) Use a circular or a side-to-side and up-and-down motion to remove the metal.

b. Safety Procedures when using a Portable Grinder or Disk Sander

- 1) Use the face of the wheel only. Grinding with the edge may cause the wheel to shatter.
- 2) Always use both hands to support the grinder or disk sander. The tool rotates at high rpm's and can fly from the project if not properly supported.
- 3) Wear a safety face shield, gloves, and a long sleeve shirt for protection from flying sparks and metal fragments.
- 4) Make sure no one is within a distance where they can be hit by the sparks.
- 5) Allow the grinding wheel or disk to come to a complete stop before setting it down on its side.
- 6) Do not touch the metal immediately after it has been disked or ground. The abrasive action will heat the metal.

6. Metalworking Lathe - The lathe holds and rotates the work while it is being shaped by a cutting tool that is fed against the work. Metalworking with a lathe requires much more precise measurement than woodworking. Measurements must be accurate to the thousandths of an inch. Therefore, a micrometer and a set of calipers is required for accurate measurements.

a. Operating Procedures for the Metalworking Lathe

- 1) Determine the dead center of each end of the metal to be lathed. A pair of dividers or a center head can be used for this purpose.
- 2) Use a center punch to mark the centers. If the initial punch is not accurate, the center punch can be driven at an angle to move the drilling hole.
- 3) Drill both ends of the metal. The drill holes should fit the lathe center perfectly to insure the correct true of the metal.
- 4) Use oil or grease in the drilled holes and attach the metal stock to the lathe using the lathe centers.



- 5) Mount the cutting tool in the tool holder and the tool holder in the tool post. Mount the tool holder in the tool post so that in case it slips, it will swing away from the work and not gouge.
- 6) Set the cutting depth using a micrometer.
- 7) Turn the machine on. Make a light trial cut that is shallower than the setup for thread cutting.
- 8) If accurate, adjust the tool holder to make the actual cut.

b. Safety Procedures when using a Metalworking Lathe

- 1) Wear safety shield or goggles.
- 2) Avoid loose clothing and tie back long hair that may get caught in the lathe.
- 3) Start the lathe at a slow speed while standing away from the direction of the rotation.
- 4) Never touch the metal while it is rotating.
- 5) Never remove scraps while the lathe is in operation.
- 6) Keep fingers and hands away from all moving parts.

7. Milling Machine - The milling machine is very useful in cutting and shaping metal. Metal is removed by a rotating multi-tooth cutter that is fed into the work.

a. Operating Procedures for the Milling Machine

- 1) Seat the work against the parallels on the machine or the bottom of a vise using a mallet or a soft hammer.
- 2) Securely fasten the work.
- 3) Set the milling machine for the proper cutting depth.
- 4) Disengage all handles if the machine has an automatic feed.
- 5) Turn the machine on and make sure it is turning in the proper direction.
- 6) Feed against or opposite to the direction of rotation of the cutter.
- 7) Release the automatic feed after the machine has been turned off and has stopped.

b. Safety Precautions when using a Milling Machine

- 1) Wear a safety shield or goggles.
- 2) Make adjustments to the machine only when it is at a dead stop.

- 3) Be sure the work is securely fastened.
  - 4) Stand to one side of the machine when starting.
  - 5) Use a brush to remove chips. Never use a hand or blow the chips clear. The chips are sharp and may cut the hand or eye.
  - 6) Keep hands clear of moving parts.
8. Oxygen-acetylene Welding - Welding is useful for joining metals together. The oxyacetylene system combines oxygen and acetylene gas to produce extreme heat that fuses the metal together.
9. Arc Welding - The arc welding machine uses electric current to weld metal together.
10. Spot Welder - Spot welding is known as resistance welding. The weld is produced by heat obtained from the resistance of the work to a flow of electric current and the application of pressure. Spot welding is frequently used in agriculture to weld sheet metal parts. It is a fast method of welding light gauge metals and produces a clear, uniform, and strong weld. It is an easier, safer, and more accurate method of welding than either arc or oxyacetylene welding.

#### D. Tools used in Both Woodworking and Metalworking

1. Drill Press - The drill press is a stationary machine used to drill holes. If used with attachments, the drill press can also be used for boring, routing, and mortising.
  - a. Operating Procedures for the Drill Press
    - 1) Set the speed of the drill, according to the diameter of the bit.
    - 2) Select the drill bit and chuck to use. Place the chuck in the drill.
    - 3) Insert the drill bit and tighten with the chuck key.
    - 4) Align work under the bit. Clamp the work securely.
    - 5) Start the drill and bring it to full working speed.
    - 6) Lower the bit using the pilot wheel feed. Do not force the bit through the metal. Use cutting oil on thick pieces of metal. Allow the bit to cut at its own speed.
    - 7) After the bit has gone through the material, release the pilot wheel feed and turn the machine power off.

b. Safety Precautions when using a Drill Press

- 1) Shift belt and make other adjustments only when the power switch is off.
- 2) Be sure that the belt guard is in place.
- 3) Secure the work to be drilled. Use a drill press or vise when possible.
- 4) Remove the chuck key immediately after using it.
- 5) Wear a safety shield or goggles.
- 6) Never wear loose clothing or gloves or allow long hair to be near the drill bit when turning.
- 7) Stop the drill press before attempting to remove work, chips, or cuttings.

2. Portable Hand Drill - The hand drill is used to drill holes into different material. Portable hand drills are made in various sizes and vary in power from light to heavy and in speeds from slow to fast.

a. Operating Procedures for the Portable Hand Drill

- 1) Select the bit to be used, insert it into the chuck, and tighten with the chuck key.
- 2) If drilling metal, use a center punch to indent the point of the hole to be drilled.
- 3) Holding the drill firmly, bring it to full working speed.
- 4) Ease the bit towards the work. Do not force the bit.
- 5) After breaking through, immediately back off on the pressure.
- 6) Remove the drill from the hole and release the trigger or power switch.

b. Safety Precautions when using a Portable Hand Drill

- 1) Wear a safety shield or goggles.
- 2) Remove the chuck key immediately after using it.
- 3) Make sure the drill is grounded either internally or with a ground wire to the outside of the drill.
- 4) Always hold the machine firmly.
- 5) Keep hands away from the revolving drill bit. Never wear loose clothing or gloves that may become entangled in the bit.
- 6) Apply straight and steady pressure. Do not force the drill bit. It may break and injure the operator.

- 7) Ease up on the pressure just before the drill begins to break through the material.
- 8) Turn the power off and allow the machine to come to a complete stop before putting it down.

#### E. Additional Shop Equipment

1. Forges and Furnaces - Gas and electric furnaces and coal forges create very high temperatures in order to heat metal for shaping.

- a. Operating Procedures for the Forge and Furnace

- 1) Consult the manufacturer's directions for operation procedures of forges and furnaces.

- b. Safety Precautions when using a Forge or Furnace

- 1) Gas Furnace

- a) Check for gas leaks.
- b) Light the furnace while standing to one side and with the doors open.
- c) Use tongs to remove metal from the furnace.
- d) Use a flint lighter and not materials to light a gas furnace.
- e) Wear a face shield or safety goggles.

- 2) Electric Furnace

- a) Be certain the furnace is properly grounded and the cable is insulated to prevent electrical shock.
- b) Remove all scale from the furnace grating. The scale can short and burn out the electric coils.
- c) Use tongs to remove hot metal from the furnace.

- 3) Coal Forge

- a) Keep the area around the forge clean.
- b) Use tongs to remove hot metal from the forge.
- c) Wear a face shield or safety goggles.

2. Storage Battery - Extra batteries are often used in the shop for faster service of tractors and other farm equipment. These batteries should be regularly serviced and charged even when not being used.

- a. Servicing Procedures for the Storage Battery

- 1) Use a hydrometer to test the charge of the battery.
  - a) Remove the cell caps from the battery.
  - b) Hold the hydrometer tube vertical and suck in a small amount of electrolyte.
  - c) Read the hydrometer with the electrolyte at eye level.
  - d) Add distilled water if the electrolyte level is low.

- 2) Charging the Battery

- a) Remove all cell covers.
- b) Provide ample ventilation.
- c) Connect the positive and negative lead wires to the respective battery terminals.
- d) Set the charge setting.

- b. Safety Precautions when using a Storage Battery

- 1) Do not overfill the battery when servicing.
- 2) Use water and baking soda to clean the top of the battery to neutralize acid.
- 3) Always use a battery lifter to remove and transport batteries.
- 4) Immediately wash clothing and any part of the body that comes in contact with the acid.
- 5) Wear goggles when using a battery charger.
- 6) Turn off charger before disconnecting leads from the charger to the battery.

ACTIVITY:

1. Compare various written and practical safety tests for the safe operation of shop machinery. Determine which ones are most valid and useful and why. Explain.
2. Build a project that utilizes as many of the woodworking tools as there are available in the shops. Simple projects such as cutting boards will utilize many of the pieces of equipment.
3. Build a project utilizing as many metalworking tools as there are in the shop.
4. Obtain and show films and videos that illustrates the importance of safety in the shop. Check to see that the school shop does not have any safety hazards.

References:

Burke, Stanley R., & Wakeman, T. J. (1990). MODERN AGRICULTURAL MECHANICS. (2nd ed.). Danville, IL: Interstate Publishers.

Cooper, Elmer L. (1987). AGRICULTURAL MECHANICS: FUNDAMENTALS AND APPLICATIONS. Albany, NY: Delmar Publishers

Special Materials and Equipment:

Safety worksheets, tools listed in the lesson, shop diagrams of tool placement.

Name \_\_\_\_\_

Date \_\_\_\_\_

Score \_\_\_\_\_

## TOOL USE AND SHOP SAFETY, EXAM

1. When should safety glasses be worn?
  - a. while grinding
  - b. while using the whetstone
  - c. when hammering
  - d. all of the above
2. The best way to remove metal cuttings or chips from your work is to use:
  - a. Your hand
  - b. Blow it away with a deep breath
  - c. A brush
  - d. A tool
3. To stop a metal lathe from rotating, you should:
  - a. use your cutting tool
  - b. blow it away with a deep breath
  - c. turn the power off
  - d. remove the tool post
4. When you turn off the switch on the portable electric drill, you should:
  - a. disconnect the electrical cord
  - b. inspect the rotor
  - c. blow the saw dust out of the armature openings
  - d. hold the machine firmly until it comes to a dead stop
5. Drill press work should be held:
  - a. with a pair of tongs
  - b. by the hands
  - c. in a vise or firmly clamped to the table
  - d. by an assistant at all times
6. You should always draw the curtains on the welding booth before you strike an arc to:
  - a. protect your eyes from the infrared and ultra violet rays
  - b. keep the work from getting cool
  - c. prevent anyone from noticing mistakes
  - d. protect anyone nearby from the infrared and ultraviolet rays

7. Before leaving heated metal unattended, you should use chalk or soapstone to label it with the word "hot" because:
- a. someone may be burned if it is touched
  - b. other work may be placed on it
  - c. you can tell to whom it belongs
  - d. other students will be afraid to steal it
8. A good neutralizer for cleaning off the top of a storage battery is water and:
- a. ammonia
  - b. baking soda
  - c. lye
  - d. lime
9. When cutting short woodstock on a band saw, the wood should be fed with:
- a. the left hand only
  - b. the right hand only
  - c. both hands
  - d. a pushstick
10. The portable electric saw is a combination of which two tools:
- a. circular saw and a power hand saw
  - b. back saw and hack saw
  - c. bow saw and electric drill
  - d. hand saw and power saw
11. The radial-arm saw is used to:
- a. cut circles
  - b. cut long pieces of wood down to a usable size
  - c. cut intricate designs
  - d. cut pipe
12. You should install the scroll saw blade to cut:
- a. on the down stroke of the saw
  - b. at minimum speed
  - c. on the upstroke of the saw
  - d. on both the up and the downstroke of the saw



13. You should feed stock into the scroll saw:

- a. in rhythm with motion of the hold down
- b. as fast as the blade will cut without bending the blade
- c. from behind the cutting blade
- d. at a rate dependent upon pulley speed

14. The jointer is used to:

- a. connect the ends of two boards together
- b. crosscut boards
- c. rip boards
- d. smooth a surface of a board

15. Never use stock on a jointer that is shorter than:

- a. 5 inches
- b. 24 inches
- c. 10 inches
- d. 3 inches

16. The shaper can be used to:

- a. cut the design on picture frames
- b. align boards to be glued and clamped
- c. smooth rough edges on metal pipe
- d. secure and rotate a piece of wood while working with hand tools

17. To avoid breathing problems due to sawdust when using a belt sander, the operator should:

- a. continually blow the sawdust away
- b. angle the sander to shoot the dust away from the operator
- c. open the window
- d. wear a respirator

18. The tool rest on a wood turning lathe should be set so it is:

- a. in slight contact with the stock
- b. below and left of center
- c. the same distance as the length of the tool handle being used
- d. one-quarter inch or less from the rough stock

Answer Sheet

1. D
2. C
3. C
4. D
5. C
6. D
7. A
8. B
9. D
10. A
11. B
12. A
13. B
14. D
15. C
16. A
17. D
18. D

Tool Identification: Lay out different tools on the work benches or tables and have students write down the proper names of the tools.

## TOOL IDENTIFICATION

Write in the proper names of the tools in the blank spaces provided.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

4. \_\_\_\_\_

5. \_\_\_\_\_

6. \_\_\_\_\_

7. \_\_\_\_\_

8. \_\_\_\_\_

9. \_\_\_\_\_

10. \_\_\_\_\_

11. \_\_\_\_\_

12. \_\_\_\_\_

13. \_\_\_\_\_

14. \_\_\_\_\_

15. \_\_\_\_\_

16. \_\_\_\_\_

17. \_\_\_\_\_

18. \_\_\_\_\_

19. \_\_\_\_\_

20. \_\_\_\_\_

21. \_\_\_\_\_

22. \_\_\_\_\_

23. \_\_\_\_\_

24. \_\_\_\_\_

25. \_\_\_\_\_

26. \_\_\_\_\_

27. \_\_\_\_\_

28. \_\_\_\_\_

29. \_\_\_\_\_

30. \_\_\_\_\_

31. \_\_\_\_\_

32. \_\_\_\_\_

33. \_\_\_\_\_

34. \_\_\_\_\_

35. \_\_\_\_\_

36. \_\_\_\_\_

37. \_\_\_\_\_

38. \_\_\_\_\_

39. \_\_\_\_\_

40. \_\_\_\_\_

41. \_\_\_\_\_

42. \_\_\_\_\_

43. \_\_\_\_\_

44. \_\_\_\_\_

45. \_\_\_\_\_

46. \_\_\_\_\_

47. \_\_\_\_\_

48. \_\_\_\_\_

49. \_\_\_\_\_

50. \_\_\_\_\_

# Tools and Equipment

Awl



6 1/4-7 1/8"

Bar, crow



48-66"

Bar, wrecking



12-48"

Bevel, sliding T



8" blade

Bit, auger, solid center



10"

Bit, expansion



10"

Bit, holder, extension



12"

Bit, masonry



6-16"



3-6"

Bit, screwdriver



(straight or phillips, torx)  
2-3"

Bit, spade



7"long

Blade metal, abrasive cut-off



10-14"

Brace, carpenter's



(10" sweep)

Brush, paint



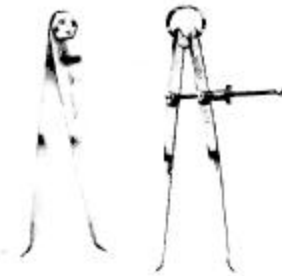
7" long, 1/2-6" wide

Brush, steel wire



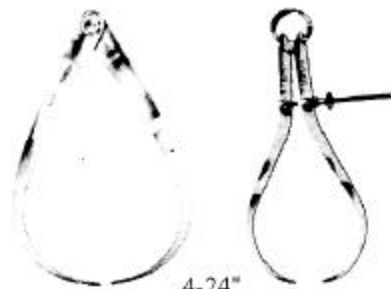
6-14"

Calipers, inside



4-12"

Calipers, outside



4-24"

Calipers, vernier



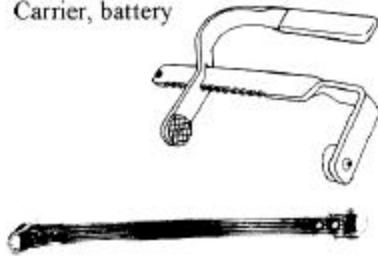
9-18" long

card, file



8"

Carrier, battery



12-24"

Chain, chainsaw, chipper



Chain, chainsaw, chisel



Chain or tape, surveyors



Chisel, cape



5-7"

Chisel, cold



5-8 1/2"

Chisel, diamondpoint



5-8"

Chisel, roundnose



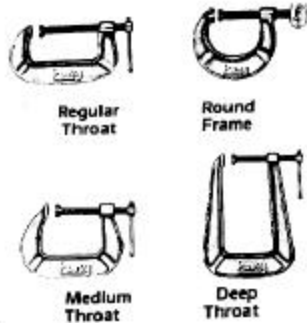
5-8"

Chisel, wood



7-9" long  
1/4-2" wide

Clamp, "C"



2-16"

Clamp, fixtures, I bar



2-8'

Clamp, fixtures, pipe



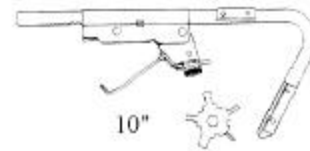
2-8'

Cleaner, battery post

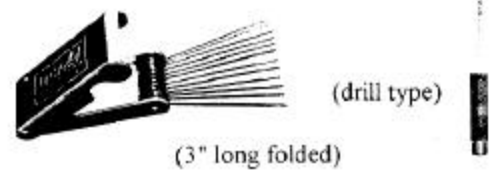


3"

Cleaner, ring groove



Cleaner, oxy-acet tip

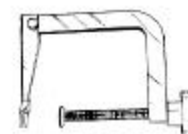
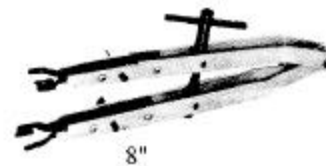


Compressor, piston ring



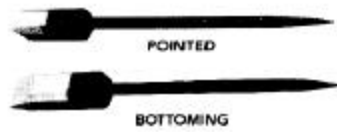
2-6" diameter

Compressor, valve spring



6-20"

Copper, Soldering



14"

Countersink



2-4"

Creeper, Auto



36"x27"

Cutter, bolt



14-42"

Cutter, glass



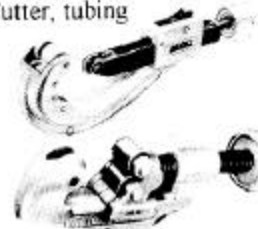
6"

Cutter, pipe



18"

Cutter, tubing



2 1/2-8"

Cutter, valve seat



Box  
9"x12"



Die stock



10-24"

Die, thread cutting



1-3" diameter

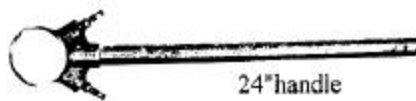


Die, pipe threading



2-4" diameter

Die, pipe threading 'handle



24" handle

Divider, spring



6-24"

Divider, wing



6-24"

Dresser, Emery wheel



14"



14"



2-3" square

Drill, electric



Drill, hand



12"

Drill, star



8-14"

Drill, twist, straight



2-7"

Drill, twist, taper shank



8-24" long

Driver, bushing



1/4-2" diameter, 4-10" long

Driver, nut



6"

Edger, concrete



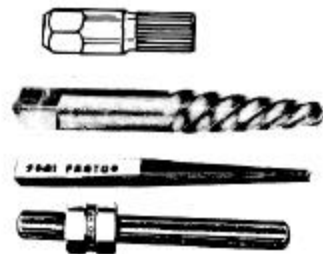
4"

Expander, piston ring



6"

Extractor, screw



2-5"

Extractor, tap



3"

File, chainsaw



6-12"



File, doublecut, flat



6-14"

File, mill



6-14"

File, round



6-14"

File, slim taper



6-14"

File, square



6-14"

Flaring tool, copper tubing



6 1/2"

Float, concrete



←magnesium



←rubber



←wood

8-24" long

Gauge, depth



6"

Gauge, dial indicator



1 1/2" diameter

Gauge, screw pitch



(3" long folded)

Gauge, small hole



4"

Gauge, tap and drill



2x5"

Gauge, telescoping



4"

Gauge, thickness



(leaves 1/2 x 3")

Gauge, wire ( American Standard)



3" diameter

Gauge, wood marking



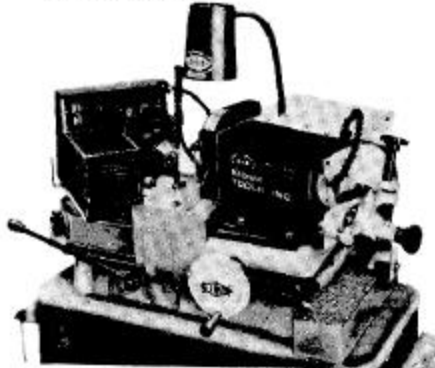
8"

Grinder, electric disc



4-10" diameter  
disc

Grinder, valve



36" wide

Grinder, valve seat



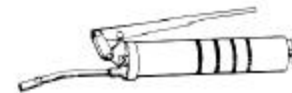
( Box- 24" wide)

Gun, caulking



(15" plunger in)

Gun, grease



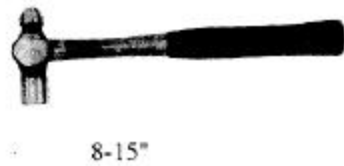
18"

Gun, soldering



12"

Hammer, ball pein



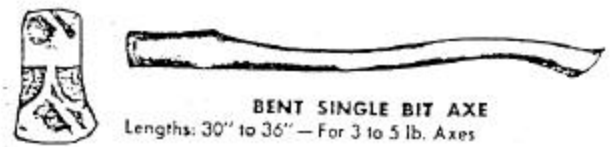
Hammer, Tinner's riveting



Hammer, bell faced, curved claw



Handle, axe



Hammer, bell faced, straight claw



Handle, file



Hammer, Blacksmith's cross pein



Hammer, chipping or slag



all 4" long

Handle, hand saw



Hatchet, broad



18"

Handle, Machinist's hammer



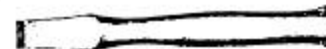
**MACHINIST'S BALL PEIN HAMMER**  
Lengths: 10" to 24" — For 2 oz. to 48 oz. Hammers

Hatchet, half



18"

Handle, nail hammer



**NAIL OR CLAW HAMMER**  
Lengths: 12" to 16" — 10"

Hatchet, shingling



18"

Handle, plane



4"

Holder, flywheel



18"

Handle speeder



12-24"

Hone, brake cylinder



12"

Hone, cylinder



4" long stones

Indicator, speed



6"

Iron, soldering, electric



14"

Jack, hydraulic



6-12" tall



26-60" long

Jack, screw

12-24" tall



Knife, draw



15"

Knife, linoleum



7"

Knife, putty



7"

Knife, utility



6"

Level, carpenter's



18-48"

Level, transit



Scope 12-18"

Lifter, valve



8"

Line, chalk



5"

Light, timing



10"

Mallet, rubber or wood



15"

Light, trouble



Micrometer, outside



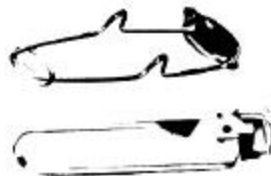
3-12"

Micrometer, inside



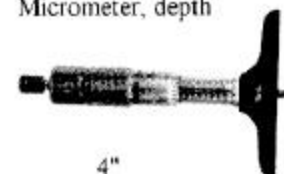
2-7"

Lighter, spark



8"

Micrometer, depth



4"



Oil can, pump type



Oil can, spring bottom



Plane, block



6"

Plane, jack



14"

Plane, jointer



24"

Plane, smooth



10"

Pliers, battery or gripping



6"

Pliers, tongue and groove



4-24"

Pliers, diagonal cutting



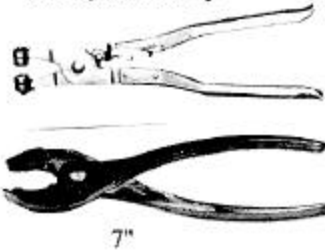
6-8"

Pliers, fencing

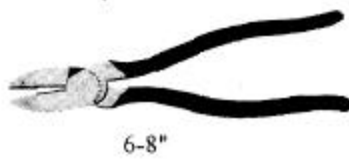


12"

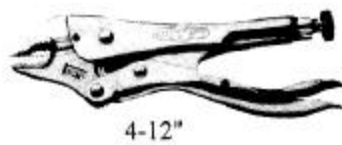
Pliers, hose clamp



Pliers, Lineman's



Pliers, locking



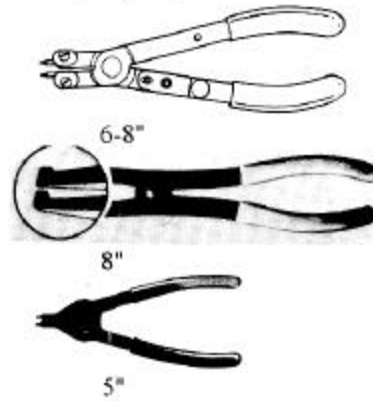
Pliers, needlenose



Pliers, roundnose



Pliers, snap ring



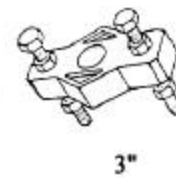
Pliers, universal slip joint



Plumb bob



Puller, flywheel



Puller, gear



3-12" Jaws

Puller, nail



10"



16"

Punch, center



6"

Punch, long taper (Aligning)



6-12"

Punch, pin



6-10"

1/16-3/8" small end diameter

Punch, roll pin or pilot



Punch, sheet metal



10"

Punch, starter



6"

Rasp, wood, flat



8-12"

Rasp, wood, half round



8-12"

Reamer, cylinder ridge



3" diameter

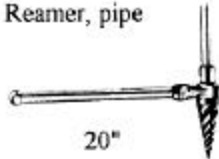
5" tall

Reamer, expansion



5-20"

Reamer, pipe



20"

Regulator, Acetylene or Oxygen



Acetylene-left hand male thread inlet-max press 400  
Oxygen-right hand female thread inlet-max press 3000

Remover, stud



2-3" long

Ripper, cable



3"

Riveter, pop



12"

Rule, Machinist's



6-36"

Saw, back



12-14" blade

Saw, circular, combination



6-12" diameter

Saw, circular, plywood



6-12" diameter

Saw, compass



12-14" long blade, 8 teeth/inch

Saw, coping



6" blade

Saw, hole



1/2-6" diameter

Saw, hand crosscut



26-30" blade



(Courtesy: E. C. Atkins and Co.)

5.12. Views showing a properly filed and set crosscut hand saw. Note the bevel on the front of the teeth.

Saw, keyhole



10" blade, 10 teeth/inch

Saw, meat



12-24" blade

Saw, hand hack



10-14" blade

Saw, pruning



18"

Saw, hand rip



26-30" blade



(Courtesy: E. C. Atkins and Co.)

5.13. Views of a section of a rip saw which has been correctly filed and set. Note there is no bevel on the front of the teeth. The teeth are filed straight across.

18-24"

Scraper, cabinet



3-6"

Scraper, carbon



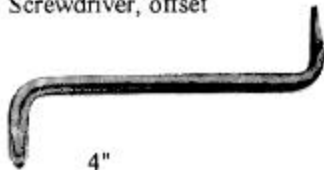
7"

Screwdriver, common



4-18"

Screwdriver, offset



4"



4"

Screwdriver, Phillips



4-18"

Screwdriver, stubby



3"

Screwdriver, torx



6-12"

Scriber



6"

Set, nail



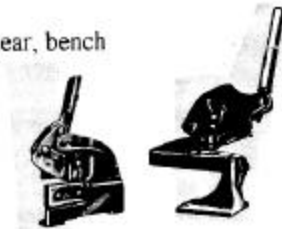
4-6"

Set, rivet



6"

Shear, bench



Shear, pruning



24"



9"

Shear, squaring



Snips, Tinner's, combination



Socket, 6 point



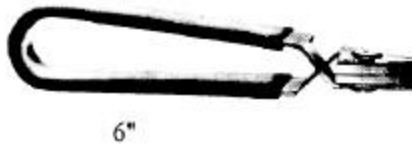
Shield, face



Socket, 8 point



Sink, heat



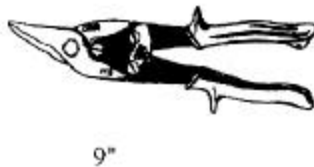
Socket, 12 point



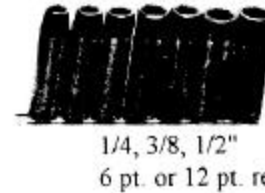
Sledge, Blacksmith, double face



Snips, Tinner's Aviation



Socket, deep



Socket, impact



6 pt -3/8, 1/2" drive  
regular or deep

Socket, reducer



1/2" to 3/8"  
3/8" to 1/4"

Socket, universal



1/4, 3/8, 1/2" drive

Splitter, nut



5"

Splitter or Separator, bearing



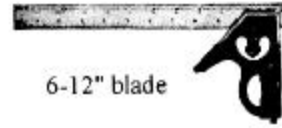
3-9" at B

Spoon, brake adjusting



9"

Square, combination



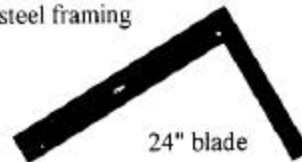
6-12" blade

Square, protractor head



12" blade

Square, steel framing



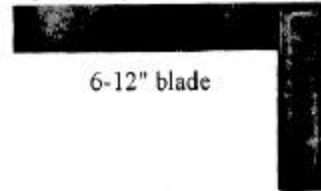
24" blade

Square, T



18-36"

Square, Try



6-12" blade

Stone, bench, sharpening



3-8"

( white, gray, black, brown)



Stripper and Crimper, wire



9"

Tachometer, vibration



3" diameter

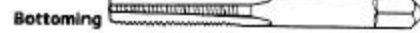
Tap, Machinist's hand



Taper



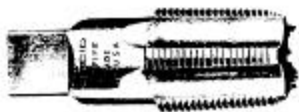
Plug



Bottoming

0-80- 3/4" x 4" long

Tap, pipe



pipe sizes 1/8 - 1" x 3" long

Tape, flexible steel



6' -300' tape length

Tester, compression



2-3" diameter dial

Tester, spark



12"



3"

Torch, cutting



15-30"

Torch, propane



16" tall with tank

Torch, welding



8-18"

Trowel, masonry, brick



10-12" blade

Trowel, masonry, pointing



4 1/2-6" blade

Trowel, concrete



4"x12, 14, 16"

Trowel, plasterer's



4 1/2-5" x 11, 12, 14"

Vise, carpenters



handle 10-12"

Vise, drill press



6-20"

Vise, Machinist's



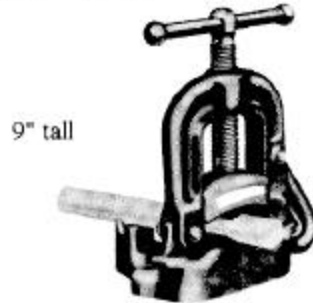
(2-8" wide jaws)

Vise, pipe, chain type



12" wide

Vise, pipe, hinged type



9" tall

Wedge, falling



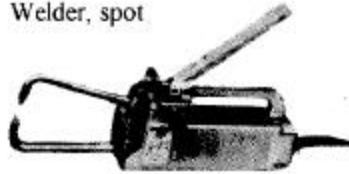
7-11" ( plastic or aluminum)

Wedge, splitting



7-11" ( steel)

Welder, spot



24-30" overall length

Welder, plastic



A complete plastics welding outfit for production and general shop use, or vocational trade school. Kit contains S-1188 Unit items plus one tacking tip and handy plastic carrying case with complete instructions and VCR tape.

Wheel, emery grinding



2-16" diameter

Wrench, adjustable



4-24"

Wrench, distributor



8-15"

Wrench, double end, tappet



12-15"

Wrench, double offset, box pattern



5-14" long

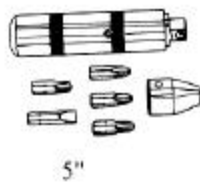
Wrench, hex



Wrench, ignition



Wrench, impact, hand



Wrench, impact, electric or air



Wrench, internal pipe



Wrench, oil filter



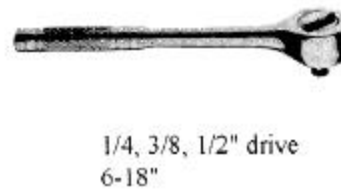
Wrench, pipe, chain



Wrench, pipe, stillson type



Wrench, ratchet

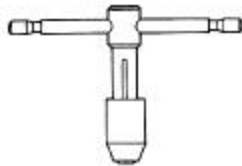


Wrench, starter clutch



3" diameter  
3" tall

Wrench, tap, T-handle



3-6" handle

Wrench, torque



in.-lb. or ft.-lb.  
10-24"  
1/4, 3/8, 1/2" drive

# Hardware Identification

## Anchors, concrete

SELF DRILLING ANCHOR DOUBLE EXPANSION ANCHOR



THREAD SIZES  
1/4" THRU 3/4"



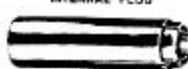
THREAD SIZES  
1/4" THRU 1"

MACHINE SCREW ANCHOR



THREAD SIZES  
5/32 THRU 3/4-10

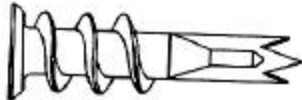
STEEL ANCHOR



INTERNAL PLUG  
THREAD SIZES  
1/4" THRU 3/4"

1 1/2-2 1/2"

## Anchor, sheetrock



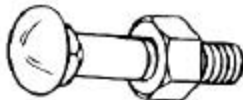
2" ( metal)

## Block, Snatch



2-8" diameter pulley

## Bolt, carriage



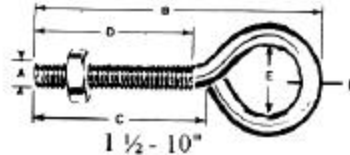
1/4 - 1/2" diameter  
1-10"

## Bolt, door, barrel type



3-4"

## Bolt, eye



1 1/2 - 10"

## Bolt, foundation



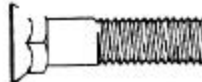
8-12"

## Bolt, machine (cap screw)



1/4 x 1/2" to 3/4 x 10" N.C. or N.F.

## Bolt, plow



Diameters 3/8" thru 1-1/4"

Lengths 1" thru 8-1/2"

## Bolt, shoulder



1/4 x 2" to 1/2 x 4"

Bolt, stud



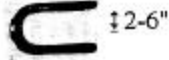
1/4 x 2" to 3/4 x 4"

Bolt, toggle



1/8 x 2" to 1/4 x 6"

Bolt, U



1/2-6"

3/16 to 1/2 " diameter bolt

Box, electrical, outlet or junction



4x4" x 1 1/2 to 2 1/2 deep

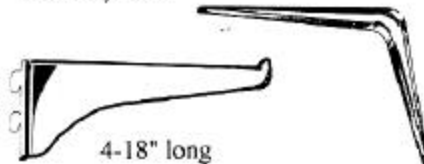
( metal or plastic)

Box, electrical, receptacle or switch



2x4" x 1 1/2 to 2 1/2 deep

Bracket, shelf



4-18" long

Brad, wire



15-20 gauge, 1/2 - 1 1/2 " long

Bushing



Plastic or metal

1/2 -2" diameter, 1/4 -3" long

Cable, "Romex" non-metallic



14-10 gauge ( has paper filler)

Cable, " Romex", underground feeder



14-10 gauge ( no paper filler)

Cap, electric cord , plug



Caster, roller



1-8" diameter wheel

Caulking



10" long roll

Chain, roller



1/4 " -1" wide

1/2 - 1 1/2 long links

Clamps, hose



Clip, wire rope



Clevis, common



Cloth, emery

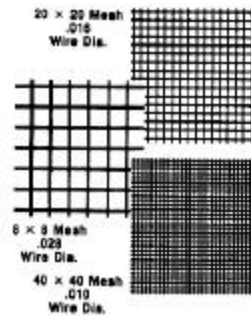
8 1/2 x 11 sheets  
1-2" strips  
Abrasive with cloth backing

Clevis, screw pin



Cloth, wire

Galvanized, stainless steel, brass,  
copper, plain steel, aluminum  
20x20 means 20 openings per inch each way



Clip, Alligator



Conduit, thin walled



Clip, hairpin





Connector, electrical cord



Connectors, solderless



- Heavy ribs for easy grip
- Standard colors for easy identification
- Approved for copper and/or aluminum wire
- U.L. listed

Stock No.	Wire Comb.	Range	Color	Box/100
22-6600	22B=3 #16		Black	55.10
22-6602	22B=3 #16 & 1 #18		Orange	6.50
22-6604	24B=2 #14 & 3 #16		Yellow	6.90
22-6606	26B=2 #10 & 1 #12		Red	9.50

Coupler, air and nipple



1 1/2" - 2 1/2"

Fastener, corrugated



1/2-1" long

Fiberglass, corrugated



comes in 2' wide sheets

Fittings, grease



1/2 - 1"

Fuse, automotive



1/2 - 1 1/2"

Fuse, cartridge



1-4"

Fuse, plug



1" diameter

Glide, furniture



Grommet



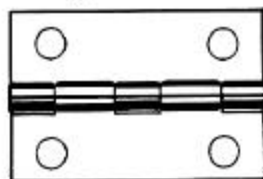
Hanger, joist



Hasp, safety



Hinge, butt



Hinge, continuous



Hinge, strap



Hinge, T



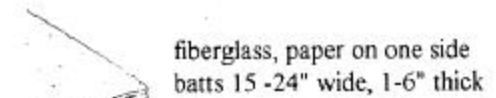
Hook, gate



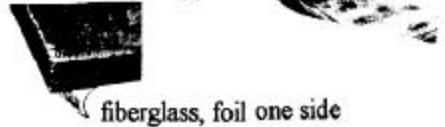
Insert, threaded



Insulation, batt type



Insulation, foil type



Insulation, granulated type



Insulation, pipe



1-4" diameter

Iron, angle



3/4 - 6" legs

Iron, channel

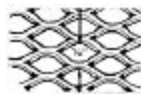


3/4 - 6" wide

Iron, deck plate



Iron, expanded metal



Iron, galvanized

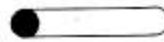
Any shape iron coated with zinc

Iron, I-bar



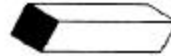
2-8" tall

Iron, round



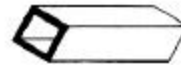
1/4 to 2" diameter

Iron, square



1/2 - 2" square

Iron, square tubing



1/2 to 6" square

Key, woodruff



1/4 - 1 1/2" long

Key, stock



1/16 - 1/2 x 12" long

Latch, door



Link, chain repair



1-3"

Lock, door



4" long

Lock, drawer



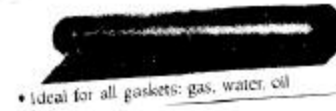
2"x3"

Lock, pad



1/2-3"

Material, gasket



• Ideal for all gaskets: gas, water, oil

black, cork, gray, green,  
varying thicknesses, 1/32 - 1/8"

Metal, sheet, corrugated, aluminum



2' or 3' width x any length

Metal, sheet, corrugated, galvanized



2' or 3' width x any length

Nail, box



Nail, cement coated



(coated with brown glue)

Nail, common



Nail, duplex (double headed)



Nail, finish



Nail, galvanized box



(coated with zinc)

Nail, joist hanger



(actual size)

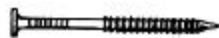
Nail, roofing, neoprene washer



Nail, masonry



Nail, ring shank



Nail, roofing, large head



1-2"

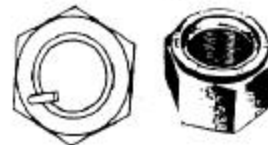
Nut, castellated



Nut, machine N.F.



Nut, self locking



Nut, standard N. C.



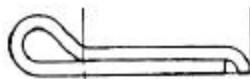
Nut, thumb (wing)



Paper, emery  
8x11 sheets  
Abrasive - black,  
paper backing

Paper, sand  
8x11 sheets  
Light brown abrasive

Pin, common cotter



1/2 - 3"

Pin, lynch



2-3" diameter

Pin, roll or tension



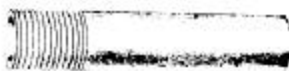
1/16 - 1/2" diameter

Pipe, black iron



1/8-2" diameter

Pipe, galvanized iron



1/8-2" diameter

Pipe, iron fittings

Elbow, 90°



Elbow, 45°



Elbow, street, 90°



Tee



Cap



Union



Union, dielectric

For connections between dissimilar metals. Designed for air and water service. Maximum pressure: 250 psi. Maximum temperature: 210° F.



Plug



Bushing



Coupling



Nipple



Pipe, plastic, ABS DWV - black



1 1/2 - 4" diameter

Pipe, plastic, PVC - White



1/2 - 4" diameter

Pipe, plastics, ABS Fittings - black

Pipe, plastic, PVC fittings - white



SP x Hub  
**90° 1/4 Bend  
Street Elbow**



SP x Hub  
**45° Street Elbow**



FPT x Hub  
**Female Adapter**



MPT x Hub  
**Male Adapter**



MPT  
**Plug**



Hub x Hub  
**90° Elbow  
1/4 BEND**



Hub  
**Closet Flange**



Hub x Hub  
**Coupling**



**90°  
Elbow**



**45°  
Elbow**



**Tee**



**Coupling**



**Female  
Adapter**



**Male  
Adapter**



**Cap**



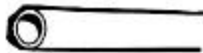
**Union**

Pipe, copper, flexible



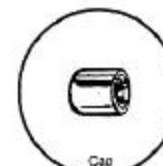
1/4 - 1/2" diameter  
comes in 50' roll

Pipe, copper rigid



1/2 - 3" diameter  
10' or 20' lengths

Pipe, copper rigid fittings



Plate, strike



2 1/2"

Point, glazier



1/4 - 1/2"

Receptacle, duplex



Ring, retaining, E- clip



Ring, Snap, external



Ring, snap, internal



Rivet, blind or pop





Rivet, copper and burr



1/2 - 1 1/2"  
use # 7 x 1/2 for point plunger plug

Rivet, counter sunk head, soft iron



3/4 - 1 1/2"

Rivet, flat head, soft iron

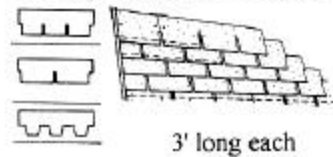


1/2 to 2"

Rivet, round head, soft iron

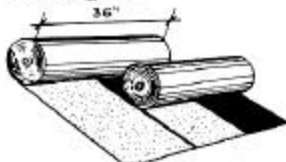


Roofing, composition shingles



3' long each

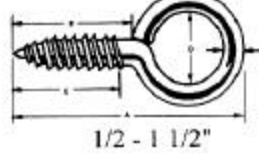
Roofing, roll



Screw, dry wall



Screw eye



1/2 - 1 1/2"

Screw, lag



1/4 - 1/2" diameter  
1" - 8" long

Screw, machine flat head



0-80 to 12-24

Screw, machine round head



0-80 to 12-24

Screw, molly

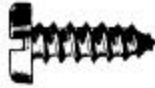


1 1/2-2" long

Screw, self drilling

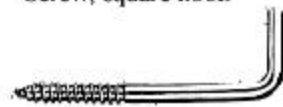


Screw, sheet metal



1/4 - 1"

Screw, square hook



1-3"

Screw, thumb



1-2"

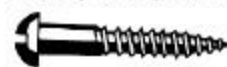
Screw, wood, flat head



1/4 - 4"

black, bright, bronze

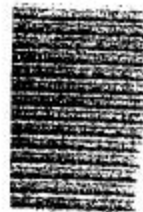
Screw, wood, round head



1/4 - 4"

black, bright, bronze

Sealer, sill



6" wide roll  
1/4 - 1" thick  
could be blue or  
yellow foam or  
fiberglass

Sheetrock ( gypsum)



comes in 4'x8, 10 or 12'  
1/4" - 5/8" thick  
gypsum rock covered by paper on outside

Shield, expansion



Available in: SHORT AND LONG  
DIAMETERS AVAILABLE  
1/4" THRU 3/4"

Shimstock



.001 - .015 thick  
brass, steel, aluminum

Slide, drawer



18-24"

Soapstone



Flat Square Round

4" x 1/8 - 1/4"

Solder bar



Bar solder is available in 1 lb. bars. Uniform distribution of tin-lead alloys provides more efficient and easy application.

Solder, flux core



1 pound rolls

hollow in solder contains flux  
1/16 - 1/8 diameter solder

Solder, solid core



1 pound rolls  
1/16 - 1/8 diameter solder

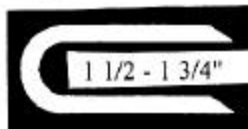
Spring, compression coil



Spring, extension coil



Staple, fence



1 1/2 - 1 3/4"

Staple, poultry netting



3/4"

Staple, Romex



1" long points

Steel, tool



Octagonal



Hexagonal

Switch, single pole



has 2 terminal screws

Switch, 3 way



has 3 terminal screws

Tack, Carpet



1/4 - 1/2"

Tack, double pointed



No. 9 No. 10 No. 11 No. 12 No. 14

5/16 - 1 1/16"

Tape, electrical, plastic



black 3" diameter new

Tape, Duct



gray 6" diameter new  
2" wide

Tape, Masking



tan, 5" diameter  
1/2 - 1" wide

Tape, teflon, plumbing



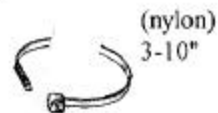
Terminals, wire



Thimble, wire rope



Tie, cable

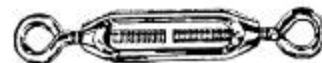


Tubing, heat shrink



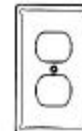
- Shrinks to half original size when heated
- Insulate terminals, connectors, tool handles and wire splices
- 6' lengths, black, assorted diameters, 23 total pieces

Turnbuckle



3/16 to 1/2" diameter bolt  
3-10" long

Wall Plate, receptacle, duplex



2 1/2 x 4 1/2"  
white, brown, metal

Wall Plate, Switch



2 1/2" x 4 1/2"  
white, brown, metal

Washer, flat



iron, fiber, brass  
aluminum, nylon, felt  
1/4-2" diameter

Washer lock



1/16 -2" diameter

Wire, baling



single strand

Wire, barbed



Wire, Poultry netting



mesh 1 1/2"  
roll 6 ' tall